TABLE 2 OF § 1065.910.—95% CONFIDENCE INTERVAL CRITICAL t VALUES FOR T-TEST

n-1	t_{crit}
6	2.45
7	2.36
8	2.31
9	2.26
10	2.23
11	2.20
12	2.18
13	2.16
14	2.14
15	2.13
16	2.12
17	2.11
18	2.10
19	2.09
20	2.09

§ 1065.915 Equipment specifications for SI engines.

This section describes equipment you may use to measure in-use emissions. You may use other equipment and measurement systems that conform to the requirements of §§ 1065.905 and 1065.910.

(a) The primary components of the in-use measurement system are a mass air flow sensor, a portable FID, a zirconia-based NO_X sensor, a zirconia-based air/fuel ratio sensor, and a portable NDIR analyzer.

(1) The mass air flow sensor must meet the requirements of § 1065.930.

(2) The portable FID must meet the requirements of § 1065.935.

(3) The NO_X and air/fuel sensors must meet the requirements of § 1065.940

(4) The NDIR analyzer must meet the requirements of § 1065.945.

(b) You must measure the following parameters continuously at a rate of 3 Hz or higher and store the data electronically:

(1) THC, NO_X, CO concentrations.

(2) Mass air-fuel ratio.

(3) Intake air flow rate.

(4) Engine speed.

(5) Parameters used to calculate torque.

(c) You must minimize sample line length for any analyzers that require a physical sample be drawn from the exhaust to the analyzer (*i.e.,* THC and CO analyzers). You must draw these samples at a constant flow rate. In no case may you use any combination of sample line length and sample flow rate that would require more than 10 seconds for the analyzer to reach 90 percent of its final response after a step change to the input concentration at the opening of the sample probe. For residence time delays between 1 and 10 seconds, you must correct the measurements to be consistent with the data for engine speed, torque, and air intake. You may also correct other measurements with less than delays less than 1 second.

(d) You may insert the sample probes and sensors into the exhaust pipe, or mount them in an exhaust extension that is connected to the exhaust pipe with negligible leaking. Place the sample probes and sensors close enough to the center line of the exhaust pipe to minimize boundary layer effects from the wall.

§ 1065.920 Equipment setup and test run for SI engines.

This section describes how to set up the equipment specified in § 1065.915, and how to use it to measure in-use emissions from SI engines.

(a) Inspect the vehicle or equipment to determine whether it meets any applicable requirements of the standard-setting part. This may include requirements related to model year, accumulated hours of operation, fuel specifications, maintenance history, engine temperatures, etc.

(b) Perform calibrations as specified in this subpart. In the field, this generally will require only zeroing and spanning the instruments. However, each instrument must have been fully calibrated according to the instrument manufacturer's specifications. Nonlinear calibrations generated previously from the full calibration may be used after zeroing and spanning the instruments. Spanning can be performed using a single gas bottle, consistent with good engineering practice, and provided that stability of the span mixture has been demonstrated.

(c) Connect the data recorder (with any necessary signal interpreters or converters) to the engine's electronic control module.

(d) Disconnect the air intake system, as necessary, to attach the mass air flow sensor. Reconnect the system after attaching the mass air flow sensor.

(e) Attach the sample extension to the exhaust outlet.

(f) Turn on instruments and allow them to warm up as necessary.

(g) Begin sampling. You do not need to begin recording the data at this point.

(h) Begin operating the vehicle or equipment in a normal manner.

NOTE: We may require you to operate the vehicle or equipment in a specific manner.

(i) Begin recording engine speed, engine torque (or surrogate), intake air flow, emissions data (THC, NO_X, CO, air/fuel ratio), and time. This time marks the beginning of the sampling period.

(j) Continue recording data and operating the vehicle or equipment in a normal manner until the end of the sampling period. The length of the sampling period is based on good engineering practice, the precision requirements of §1065.910, and applicable limits in the standard-setting part.

(k) You may measure background concentrations and correct measured emission values accordingly. However, if any background corrections are equivalent to 5 percent or more of the maximum emissions allowed by the applicable standard, the test shall be voided and repeated in an environment with lower background concentrations.

§1065.925 Calculations.

(a) [Reserved]

(b) Convert emission analyzer data to instantaneous concentrations in ppm (ppmC for the FID).

(c) Calculate instantaneous exhaust volumetric flow rates in standard m^3/hr (volume and density values used in these calculations are corrected to standard conditions of 20 °C and 101.3 kPa.). Calculate exhaust volumetric flow rate from the following equation:

Exhaust volumetric flow rate = (intake air mass flow rate)(1+mass fuel/air ratio)/(density of exhaust)

(1) If you do not know the instantaneous density of the exhaust, use the minimum density of the exhaust that occurs over the course of the test, corrected to standard conditions.

(2) For gasoline-fueled engines designed to be operated at stoichiometric fuel/air ratios, you may assume that the density of the exhaust is 1202 g/m^3 at standard conditions of 20 °C and 101.3 kPa.

(3) For LPG-fueled engines designed to be operated at stoichiometric fuel/air ratios, you may assume that the density of the exhaust is 1175 g/m^3 at standard conditions of 20 °C and 101.3 kPa.

(4) For CNG-fueled engines designed to be operated at stoichiometric fuel/air ratios, you may assume that the density of the exhaust is 1149 g/m^3 at standard conditions of 20 °C and 101.3 kPa.

(d) Calculate instantaneous emission rates (g/hr) using the following general equation:

Emission rate = (exhaust volumetric flow rate)(ppm)(density factor)/10^6

Where:

Density factors are 576.8 g/m^3 for THC, 1913 g/m^3 for NO_X, 1164 g/m^3 for CO.

(e) Integrate instantaneous emission rates for the entire specified sample period.

(f) Determine instantaneous brake torque and speed.

(g) Calculate instantaneous brake power.

(h) Integrate instantaneous brake power for the entire specified sample period.

(i) Divide the integrated emission rates by the integrated brake power. These are your final brake-specific emission rates.

§1065.930 Specifications for mass air flow sensors.

(a) Measure the intake air flow using the engine's mass air flow sensor. If the engine is not equipped with a mass air flow sensor, you need to install one.

(b) The sensor design must have an accuracy and precision of ±5 percent under steady-state laboratory conditions.

(c) The sensor must reach at least 90 percent of its final response within 0.3 seconds after any step change to the flow rate greater than or equal 80 percent of full scale.

(d) Calibrate the sensor according to good engineering practice. Verify for each engine before testing that the sensor accurately reads the idle intake air flow rate based on measured manifold